



MPE Calculations

Systems operating under the provision of 47 CFR 1.1307(b)(1) shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the FCC guidelines.

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user or nearby persons and can therefore be considered a mobile transmitter per 47 CFR 2.1091(b). The MPE calculation for this exposure is shown below.

Using the Antennas with highest output power: Ethertronics Shanghai Universe Communication Electron Co., Ltd Antennas

The peak radiated output power (EIRP) is calculated as follows:

<i>Antenna</i>	<i>Frequency (GHz)</i>	<i>Power input to the antenna (P) (dBm)</i>	<i>Power gain of the antenna (G) (dBi)</i>	<i>EIRP (P+G) (dBm)</i>	<i>EIRP $\text{Log}^{-1}(\text{dBm}/10)$ (mW)</i>
Shanghai Universe (Chain A)	2.4	23.89	3.24	27.13	516.42
Shanghai Universe (Chain A)	5	25.30	4.97	30.27	1064.14
Shanghai Universe (Chain B)	2.4	24.35	3.24	27.59	574.12
Shanghai Universe (Chain B)	5	22.40	4.97	27.37	545.76
Shanghai Universe (Chain C)	2.4	23.83	3.24	27.07	509.33
Shanghai Universe (Chain C)	5	22.58	4.97	27.55	568.85

$EIRP = P + G$

Where

P = Power input to the antenna (mW).

G = Power gain of the antenna (dBi)

The numeric gain (G) of the antenna with a gain specified in dB is determined by:

<i>Antenna</i>	<i>Frequency (GHz)</i>	<i>Antenna Gain (G) (dBi)</i>	<i>Numeric Antenna Gain $\text{Log}^{-1}(\text{dBm}/10)$ (dB)</i>
Shanghai Universe (Chain A)	2.4	3.24	2.11
Shanghai Universe (Chain A)	5	4.97	3.14
Shanghai Universe (Chain B)	2.4	3.24	2.11
Shanghai Universe (Chain B)	5	4.97	3.14
Shanghai Universe (Chain C)	2.4	3.24	2.11
Shanghai Universe (Chain C)	5	4.97	3.14

$G = \text{Log}^{-1}(\text{dB antenna gain}/10)$



Power density at the specific separation:

<i>Antenna</i>	<i>Frequency (GHz)</i>	<i>Power input to the antenna (P) (mW)</i>	<i>Numeric Power Gain of the Antenna (G) (dB)</i>	<i>Maximum Power Spectral Density $S=PG/(4R^2\pi)$ (mW/cm²)</i>	<i>Maximum Power Spectral Density Limit (mW/cm²)</i>
Shanghai Universe (Chain A)	2.4	244.91	2.11	0.103	1.00
Shanghai Universe (Chain A)	5	338.84	3.14	0.212	1.00
Shanghai Universe (Chain B)	2.4	272.27	2.11	0.114	1.00
Shanghai Universe (Chain B)	5	173.78	3.14	0.109	1.00
Shanghai Universe (Chain C)	2.4	241.55	2.11	0.101	1.00
Shanghai Universe (Chain C)	5	181.13	3.14	0.113	1.00

$S = PG/(4R^2\pi)$

Where

S = Maximum power density (mW/cm²)

P = Power input to the antenna (mW).

G = Numeric power gain of the antenna

R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)

The maximum permissible exposure (MPE) for the general population is 1mW/cm².

The power density at 20cm does not exceed the 1mW/cm² limit. Therefore, the exposure condition is compliant with FCC rules.

Aggregate Maximum Power Spectral Density:

<i>Antenna</i>	<i>Frequency (GHz)</i>	<i>Maximum Power Spectral Density Chain A (dBi)</i>	<i>Maximum Power Spectral Density Chain B (dBi)</i>	<i>Maximum Power Spectral Density Chain C (dBi)</i>	<i>Maximum Power Spectral Density Aggregate Chain A, B, & C (dBi)</i>	<i>Maximum Power Spectral Density Limit (mW/cm²)</i>
Shanghai Universe	2.4	0.103	0.114	0.101	0.106	1.00
Shanghai Universe	5	0.212	0.109	0.113	0.144	1.00